Chapter 6
Environmental change in South Central Chibuto Southern Mozambique 1965-2000: Discussion

6.1 Introduction

In the previous chapters, the history of land-use in South Central Chibuto was presented in order to show the process of land transformation, some of the driving forces and agents over time. In this chapter, environmental changes in South Central Chibuto for the period, 1965-1995 are synthesised and presented. Some of these changes include either periods of intensification or de-intensification, conversion or modification of land-use. Relationships between change and land degradation are also discussed.

Two main land-use types of land-use, namely agriculture and settlement are discussed. These two sectors experienced significant change through time. As has been shown previously, the area under study is an agrarian region where agriculture is the main activity, which together with settlement were the main foci of land-use policy. These sectors are also the most affected by biophysical drivers producing complex land-use and land-cover pathways.

In the first section, the interaction between the two main land-use categories are analysed while in the second section the impact of land-use changes and some of the consequences of these changes, including impact on local livelihoods are examined. Due to the dynamic character of the study, the future trends of land-use under the influence of globalisation in the area, will be also discussed as the study period (1965-2000) ends at the beginning of the new century when globalisation is a key factor influencing land-use and cover changes (Lambin *et al*, 2001). The manifestation of globalization in the study area involves the process of the establishment of a huge industrial mining company for the exploration of heavy sands, as will be shown later. Future trends also to be explored in this chapter include

the examination of the impact of HIV/Aids in the study area and the impact this is having on communities, as well as impacts on land-use **(Fig.6.1)**.

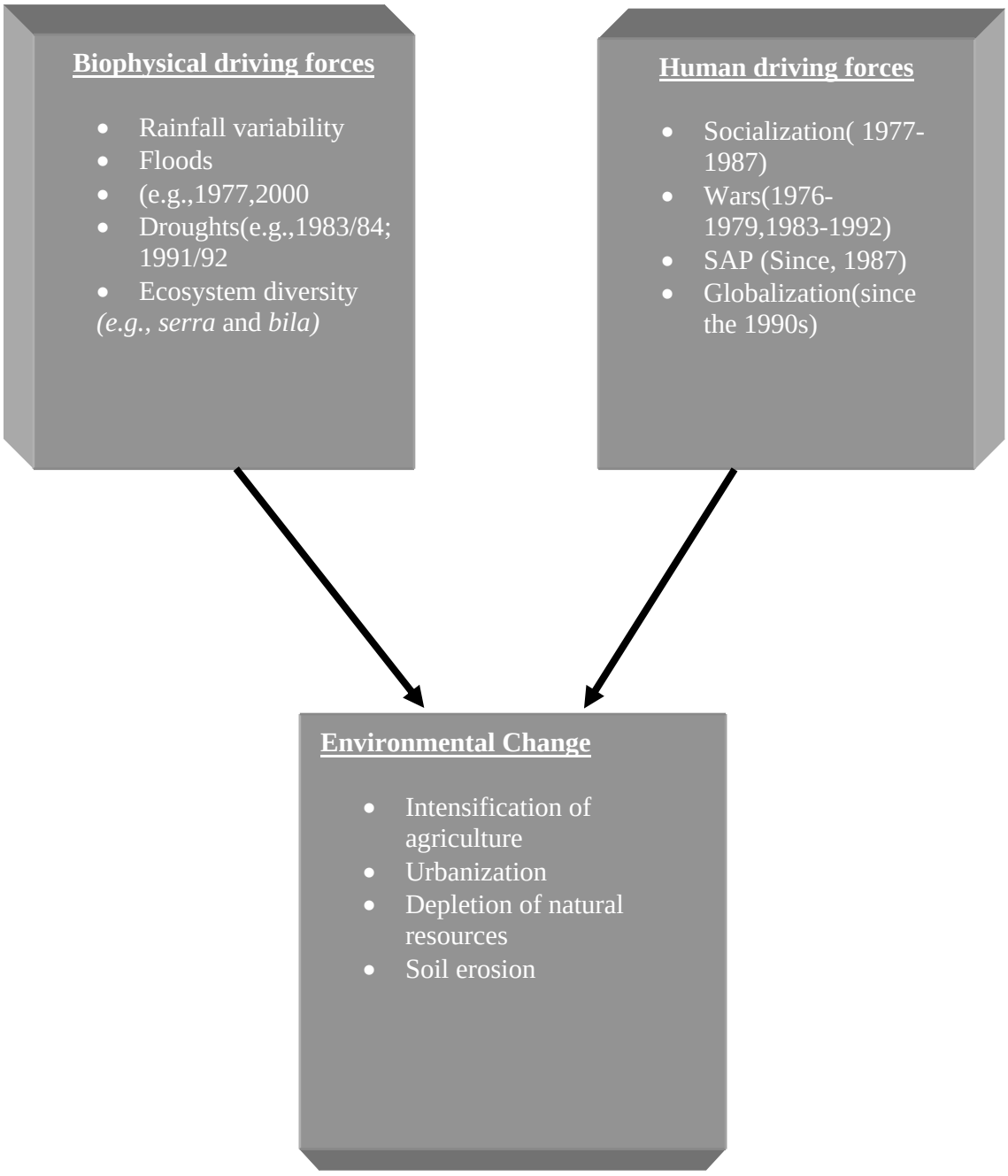

Fig 6. 1: Environmental Change in South Central Chibuto, Southern Mozambique: Summary of Causes and Consequences

6.2 Changes in Agriculture

6.2.1 Traditional Agriculture

Land use for traditional agriculture depends mostly on the combination of natural factors such as soil fertility, rainfall and agricultural practice. The combined impact of natural factors is largely related to the influence of dry and wet spells, which characterise the climate of the region. Crop yields are, for example, influenced by annual variations in rainfall as well as socio-economic factors such as a lack of agricultural implements, a situation aggravated by the war and impoverishment of the peasants. These factors can combine to hinder agricultural productivity rather than produce a decline in real productivity. During the PRA group discussion and subsequent field visits, local people confirmed the influence of the irregularities of rainfall in their crop production leading to frequent productive failures.

The examination of aerial photographs (1964, 1973 and 1989) shows that intensively cultivated lands under short fallow and less intensively cultivated long-fallow lands, including settlements, may be clearly distinguished by observing the differences in shapes, brightness and patterns on them. Cultivation frontiers and different degrees of cultivation can also be easily distinguished. The comparison of the 1964 and 1989 photographs shows more changes in the pattern of land-use. The conversion of land under traditional agriculture into urban land is the predominant pathway of change detected.

Drawing both on the above-mentioned sources of data and the use of interviews and direct observation, it was found that the major land transformation by conversion occurred during the Villagization process in the *serra* lands where the existing pattern of traditional agriculture with short- and long-fallow was converted into urban land-use (**Fig 6.2**).

The process of the construction of urban communal settlements in the *serra* impacted on the intensification of land under long-fallow due to the intensive use of the periphery of communal settlements for cultivation and the gathering of construction material and fuel wood. In a very short period of time long-fallow land became unfeasible (PRA, 1999).

In the process of conversion, land has been used for the construction of streets and houses on land, which was previously under traditional agriculture. In this process, the cultivation of crops such as groundnuts, cowpeas and manioc had been affected and people have had to travel further for cultivation, thus intensifying the use of the land on the periphery of communal settlements. Further research in the area has shown that soon after the construction of the villages the population experienced food shortages (Kanji, Vijfhuizen and Young, 2002).

The socio-economic implications of villagization were related to the drastic reduction (approximately 90%) of the availability of land for cultivation in the *serra* environment, and as a result the distances to places of cultivation (**Table 6.1**):

> "Formation of communal villages, sometimes within pre-existing cashew orchards, sometimes several kilometres from family lands and orchards, separated owners from their trees. Tree care and protection of harvests were compromised" (Kanji, Vijfhuizen and Young, 2002, 8).

6.2.1.1 The impact of the war

The war impacted on land-use in differing pathways by triggering either intensification or de-intensification in both agriculture and settlement. The analysis of aerial photographs of 1989 and successive field visits shows that the lands located furthest away from Chibuto 20 to 30 km from the Chibuto Town and surrounding communal settlements were abandoned during the war period (1983 - 1992).

These abandoned areas experienced a relative regeneration of vegetation (de-intensification). This gain from de-intensification, however, has rapidly been substantially altered by the peace achievement in 1992, which gave the households the possibility of re-expanding the agricultural frontier[15]. Besides the clearing of vegetation for agriculture, trees and shrubs of *miombo* forest in regeneration were cut for timber and charcoal (Field observation, 1992-1999). Due to the increase of the

[15] In the period immediately following the conflict an 'institutional vacuum' was created in the abandoned areas and they became vulnerable to environmental damage when the peace makes them accessible (Watson, 2001).

urban population during the war, the needs for energy expanded, so that commercial sales of timber and charcoal and building material became lucrative activities.

The de-intensification and regeneration of the natural resources, however, did not occur concentrically in relation to the residential space of the Chibuto Town and communal settlements. This is because the security during the war has not decreased concentrically from centre to periphery. The southern and western parts part of South Central Chibuto were more secure and people could travel further to flee from the war and to areas suitable for cultivation. Due to the lack of satellite images of good resolution covering this period spatially, representation of this process is unavailable in this study.

6.2.1.2 The 2000 floods

The 2000 catastrophic floods further impacted on the conversion of approximately 200ha of land under short-fallow traditional agriculture into communal settlement. The cause of this land-use change was the need for settling the affected people from lowlands floods. In this process crops (e.g. maize, cassava and cowpeas) and trees (e.g. cashew, mango and *mafurra*) were lost to open plots for new settlement.

Having described land-use change in rain-fed traditional agriculture and patterns of the use of natural resources, in the *serra* where major transformation occurred, attention now shifts to the discussion of more intensive traditional agriculture in the *bila* where irrigation is one of the ways of increasing land productivity.

6.2.2 Irrigated commercial farms

Commercial irrigated farms, which belonged to the White settlers, were nationalised after Independence and were transformed into co-operatives and state farms. In this

category of land-use, the main direction has been conversion and de- intensification (**Table 6.2**). Expansion occurred in two phases: the first in 1965-1975 is characterized by the conversion of pastures into irrigated land. During the second period, 1989-2000, land under intensive traditional agriculture was converted into irrigation schemes. In the second period certain irrigation schemes created in the 1960s were abandoned.

In South Central Chibuto, an irrigation scheme belonging to the former Samora Machel co-operative has been abandoned due to salinization and waterlogging. The degradation of this scheme was caused by poor water management practice (Macuacua, 2000). The impact of natural disasters such as floods and droughts also caused the de-intensification of the irrigation schemes. The 2000 catastrophic flood, for example, resulted in the total damage of the Christian Council of Mozambique irrigation scheme, which was awaiting rehabilitation. The 2000 catastrophic floods, which were described in detail in Chapter 5, were responsible for the destruction of nearly all irrigation of Southern and Central Mozambique. These were located in the alluvial soils of the floodplains and the fury of the water and sedimentation of coarse alluvium damaged their channels and other irrigation infrastructure.

Another problem affecting irrigated commercial farms under the co-operative is the maintenance of infrastructure such as channels, water-pumps and other mechanical structures. The engines require repair and servicing to improve their efficiency and to prolong their productive life. In this regard, the output contribution of the machines is seriously compromised by the lack of servicing and spare parts, which are not readily available. In the case of the Christian Council of Mozambique Co-operative, for example, none of the co-operatives had skills to repair the water-pumps. Funds to purchase spare parts were also unavailable (PRA, 1999; Maueia, 2000).

The process of abandonment of irrigation schemes is, however, not a linear, spatial one. Schemes close to the dune escarpments are on swampy sites, which need additional efforts for the drainage of water excess. These are most affected by water logging. In well-drained sites the irrigation schemes expanded.

The intensification of the use of irrigated land also occurs when funds from donor agencies are available. In these instances, peasants are mobilised to grow a variety of crops both in summer and in winter. In the Christian Council of Mozambique Co-operative, for example, the expansion and intensification of the irrigation scheme was observed between 1988 and 1997. From 1988 to 1997, only 100 ha of irrigation channels were established (Christian Council of Mozambique, 1988; PRA, 1999). Successive floods from 1998 to 2000 further impeded the normal activities of this irrigation scheme. The farmers have used the land within the scheme under the rain-fed regime. Further small-scale expansion of irrigated commercial farms could have occurred but no data is available on this process.

The land-use implications of irrigation schemes in general have been analysed by several academics and the situation of South Central Chibuto was not an exception to this overall tendency (Lambin *et al.*, 2001). Others, for example, found that:

> "Significant land-use intensification can also be driven by intensification, usually in state-, donor-, or NGO-sponsored projects…(however) this intensification pathway is vulnerable not only to markets but to changes in government donor policy, public sector financial constraints and inefficient management or corruption (Alteri, 1999 cited by Lambin *et al.*, 2001, 265) (Parenthesis added).

In South Central Chibuto many *ad hoc* NGO's funding of irrigation was practised during the period under study but did not trigger any long-term sustainability (Domingos Malo, pers, com, 2003). The practice of manual irrigation using buckets for growing vegetables for sale in the local market is the most durable (Bululwane, pers, com, 2003; SAVI, field visit in Maputo *Zonas Verdes*, 2003). The sustainability of this kind of micro-irrigation is that it has low capital investment in terms of skills and finance. Irrigation in this kind of agricultural activity is practised in areas of abundant ground water on the slopes of the ancient dunes.

6.2. 3 Uncultivated lands

Uncultivated lands are lands with multipurpose uses (e.g., gathering of fruits, collecting firewood, collecting medical plants, pastures etc). Some of these lands

surrounded white settler farm settlements during the colonial period and it seems that they served to protect the farms from erosion, or they may have been used as buffer zones between the settler farms and those of African peasantry. These lands are situated on very steep slopes so that even traditional agriculture cannot be practised safely on them. This land-use type experienced increasing pressure through the clearing of vegetation (modification)**.** The modification affected, for example, the potential of these areas in terms of sustaining plants, which bear edible fruits needed in periods of stress.

These previously uncultivated lands were situated on the edge of the *serra's* ancient dunes. During the war, these lands were invaded by the displaced people who began to set up temporary houses and cultivation. As a result of these activities serious erosion occurred in these lands. The sediments transported from these landscapes were then deposited in the lowland pastures and water bodies.

6. 3 Pastures

In South Central Chibuto a large area of land is devoted to pasture as indicated in Chapter 2. These sites are mostly waterlogged areas with sodic to saline soils. Some parts of this land have, however, been reclaimed during the colonial period by using adequate technology to drain and convert swampy soils into irrigated commercial land. Because of their agronomic proprieties and the drainage pattern, they are neither suitable for rain-fed agriculture nor housing (Marques, 1960; Barradas, 1966). The area consequently, experienced less change; the only observable change was the clearing of trees and shrubs for fuel wood and building materials. Due to the decreasing numbers of cattle provoked by the FRELIMO-RENAMO war, that land experienced both de-intensification and intensification. On the one hand, the de-intensification occurred due to the war and drought with deaths and stealing of cattle and goats which was widespread. On the other hand intensification occurred due to the concentration of population provoked by the war, which restricted travel and increased the concentration of cattle around the Chibuto Town (Christian Council of Mozambique, 1988). Besides grazing specialised for pasturelands, cattle could graze abandoned commercial farms and other fallow land both in the *bila* and *serra,* including

uncultivated lands. The possibility of using different ecosystems on which to graze cattle and avoid land degradation is one of the traditional strategies of cattle farming in Southern Africa, in Botswana, and in Zimbabwe (Dahlberg, 1996; Scoones *et al*., 1996).

Table 6.1: Changes in land-use under irrigation 1964-2000 in ha.

Types of use	1964	1964- 73	1973-89	1989-00
Total area at the end of the period	580	605	705	705
Added area in the period	Baseline	25	100	*

Note that the added area is a consequence of the conversion of pastures and traditional rain-fed agriculture into irrigation by private farmers and co-operatives.***** No significant land was added to the irrigation schemes**.**

6.4 Changes in settlement

Using aerial photographs and some satellite images it was relatively easy to detect the land-use change in the settlement category. This change was identified by comparing for example, 1964 and 1989 aerial photographs and satellite images of the 1900s and 2000-flood period. The study of historical data from archives and from informal interviews as well as comparing present Chibuto settlement to its colonial nucleus also shows that changes in settlement patterns exhibit a number of pathways of expansion. This is because the last decade of colonialism, 1964-74, was characterised by a steady growth in terms of area and population and culminated with the elevation of the Chibuto village into the

category of a city in 1971 (Mate, 1993). The steady growth of the town was due to the following situation at that time:

Firstly, mostly the Portuguese white community, due to the colonial segregation policy, inhabited the town. Because most of these whites were working in the Portuguese administration as civil servants, they were regularly transferred from town to town and substituted by other civil servants occupying the same houses, which belonged to specific governmental institutions. Secondly, no significant development

of economic activities demanding large areas (e.g. industry) was observed. Thirdly, when shock events, including floods occurred, African peasants relied on their relatives living in the *serra*, therefore no massive resettlement process occurred. After the receding of water, peasants retuned to their previous houses (PRA, 1999; lifestories, 2004):

> Manhiça, a 60-year dweller of Samora Machel village describing actions they took to escape the floods said that: The majority of people dwelt in the riverbank levee elevation, some almost 1m above the rest of the plain, so that floods could inundate the rest of the area beside their residences. They monitor the floods so that with further increases they transfer the cattle to higher grounds to *serra.* With further increases they move the people to temporary residences until the water resides (Manhiça pers.com, 2004).

Using informal interviews, it was found that during catastrophic floods in the past some families would move from the flood plain and find land in the *serra* and establish themselves, continuing to cultivate their land in the floodplain but not in massive permanent migrations (Mariana Tivane pers. comm., 1999).

Two years after independence, the town experienced further growth because of the building of communal settlements. In its suburbs, the 25 de Junho Communal Village was erected and the population doubled in the month February 1977 alone, during a period of severe floods. Following the FRELIMO-RENAMO war there was a further increase in population in the area. Since 1977, 1250 ha of urbanised land had been added corresponding to approximately 1000 % increase in the urbanized area. Another large expansion in the urbanised area occurred from 1989 to 2000 the increase of 200ha due to the 2000, catastrophic flood with the establishment of the Chimundo resettlement camp (**Fig 6.3**).

The expansion of Chibuto Town and the communal settlements was due to the conversion of land-use, by land been taken from traditional agriculture of short-fallow surrounding the Chibuto Town and along the road linking Chibuto and Maputo. The traditional agricultural land was interspersed with residences under traditional scattered settlement patterns. This caused further shortening of the fallow period in

the surrounding areas and the eradication of the long-fallow land-use type in this area by 1989 (**Table, 6.1 and 6.2**).

The process of change in the category of Chibuto Town and communal settlements, e. g. urbanization, confirms others assessments of 'drivers' of land-use change that have been undertaken (e.g. Lambin and Geist, 2001):

> "Land-cover change has long been viewed as being continuous, but in fact it's a disjunct process with periods of rapid change. It is often triggered by a shock event, which can initiate a cascade of changes along the system" (Lambin and Geist, 2001, 27).

Table 6.2: Changes in land-use under Chibuto Town and communal settlements (area in ha)*

Types of use	1964	1964-73	1973-89	1989-00
Total area at the end of the period	63. 75	73. 75	1323.75	1523.5
Added area in the period	Baseline	10	1250	200

Note that an added area was taken by converting traditional agriculture of short -and long fallow in the *serra* into urban land-use.
Source: Topographical map of Chibuto and aerial photographs.

One of the consequences of the increase in population was the compaction of the ground in steep slopes around the old town and the beginning of soil erosion during heavy rains initiated in 1992 and 2000.

Table 6.3: Population growth of the 25 de Junho and Samora Machel Communal Villages

Years and villages	1977	1980	1997
25 de Junho	3767	4844	11997
Samora Machel	6791	6791	7502

Source: Macuácua (2000, 22).

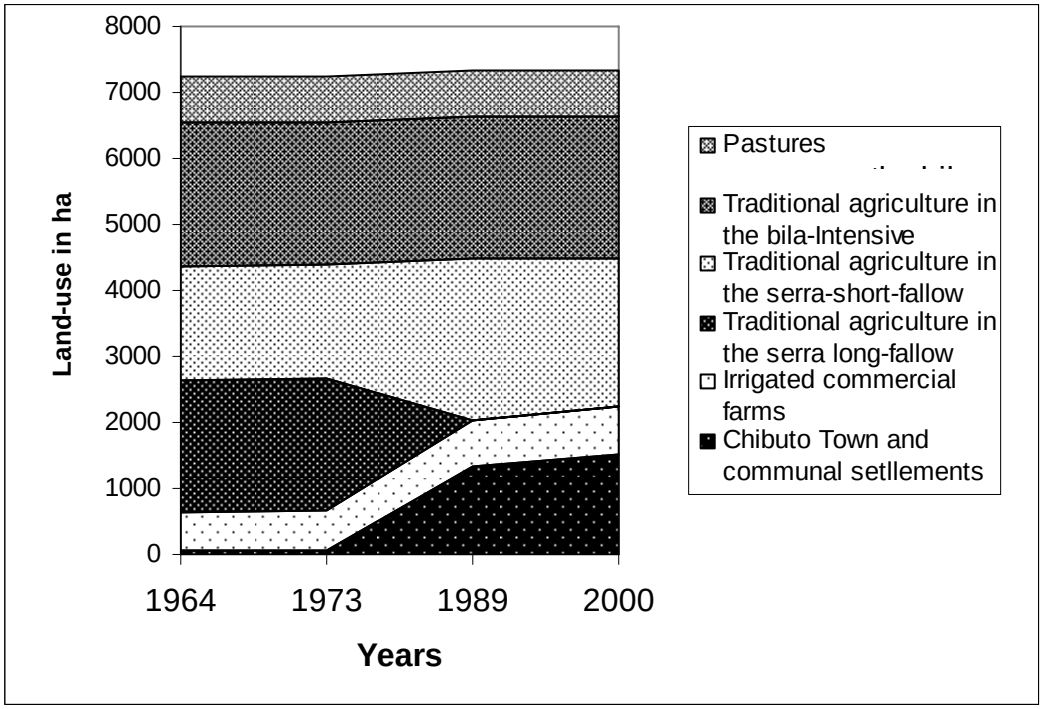

Fig. 6.2: Land- use Change in South Central Chibuto**.**
Source: Aerial photographs, satellite images and topographical maps.

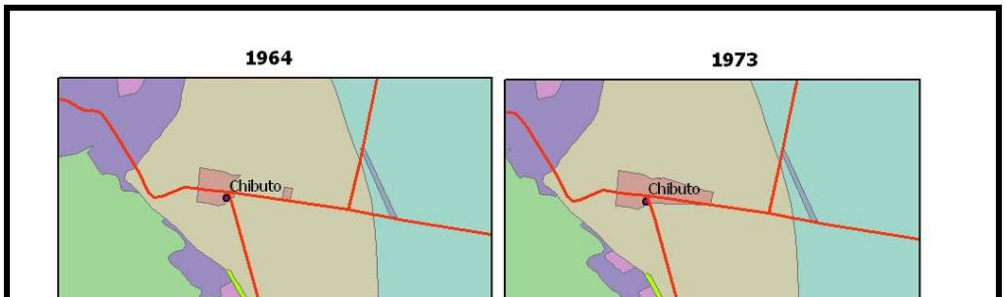

Fig. 6.3: South Central Chibuto land-use change 1964-2000.
Source: Aerial photographs (1958, 1965, 1964, 1973, 1989), satellite images topographical maps and fieldwork, 1999.

Table 6.4: Compare driving forces of land-use and cover changes and their consequences (**Fig.6.3**).

6. 5. Land-use change and environmental problems

Map representin gthe period	Drivers of Changes	Land-use pattern
1964	Baseline, colonial dual economy	Colonial Town and African rural settlement practicing traditional agriculture of different degree of intensity, white settler irrigation commercial farms and pastures
1973	Colonial dual economy	Steady growth of the colonial town and expansion of irrigated commercial farms
1989	Post independence socialization, SAP and war	Conversion of traditional agriculture in the serra into communal villages, further expansion of the town due to war resettlement, expansion of irrigated commercial farms now under cooperatives
2000	2000 Floods	Further expansion of urban settlement, creation of the Chimundo resettlement camp

During the period under study, principally after independence in 1975, there was a successive change in the institutional framework for the management of natural resources in South Central Chibuto. Villagization and resettlement negatively impacted on the effectiveness of resource management with long-term consequences on the natural environment and local peoples' livelihoods. Common property management of rivers, lakes, marshes and patches of forests was disrupted, and these resources became that of open access due to institutional failures (Manhiça, pers.com, 2004).

Both villagization and war, led to the separation of residential areas from productive spaces, resulting in valuable natural resources becoming increasingly distant from their managers' houses. The above-mentioned situation is contrary to recognised principles of common propriety management when:

> "The greater the overlap between the location of common-pool resources and the residences of the users, the greater the chances of success" (IFAD, 1995, 11).

6.5.1 Impact on uncultivated lands

Uncultivated lands are affected by accelerated erosion with gully formation on the east-facing riverbank of the Changane River. The gullies are of such a depth (some of them more than 10 m) that both domestic animals and men, including agriculture machinery, cannot cross them**.** These gullies mostly affect the movement of the people from water sources and fields in the lowlands of the *bila* landscape towards their homesteads situated in the uplands. People cross these *badlands* usually with heavy loads on their heads, such as water and agricultural products. The gullies are formed by the runoff, which concentrates on the main road crossing the slopes perpendicularly, the one linking Chibuto to the National road N1. The runoff erodes mostly the land between this road and the Changane River, deposing the sediments in the flood plain. The figures below (**Fig. 6.4 and 6.5),** show the location of the gullies in relation to the roads and the rivers.

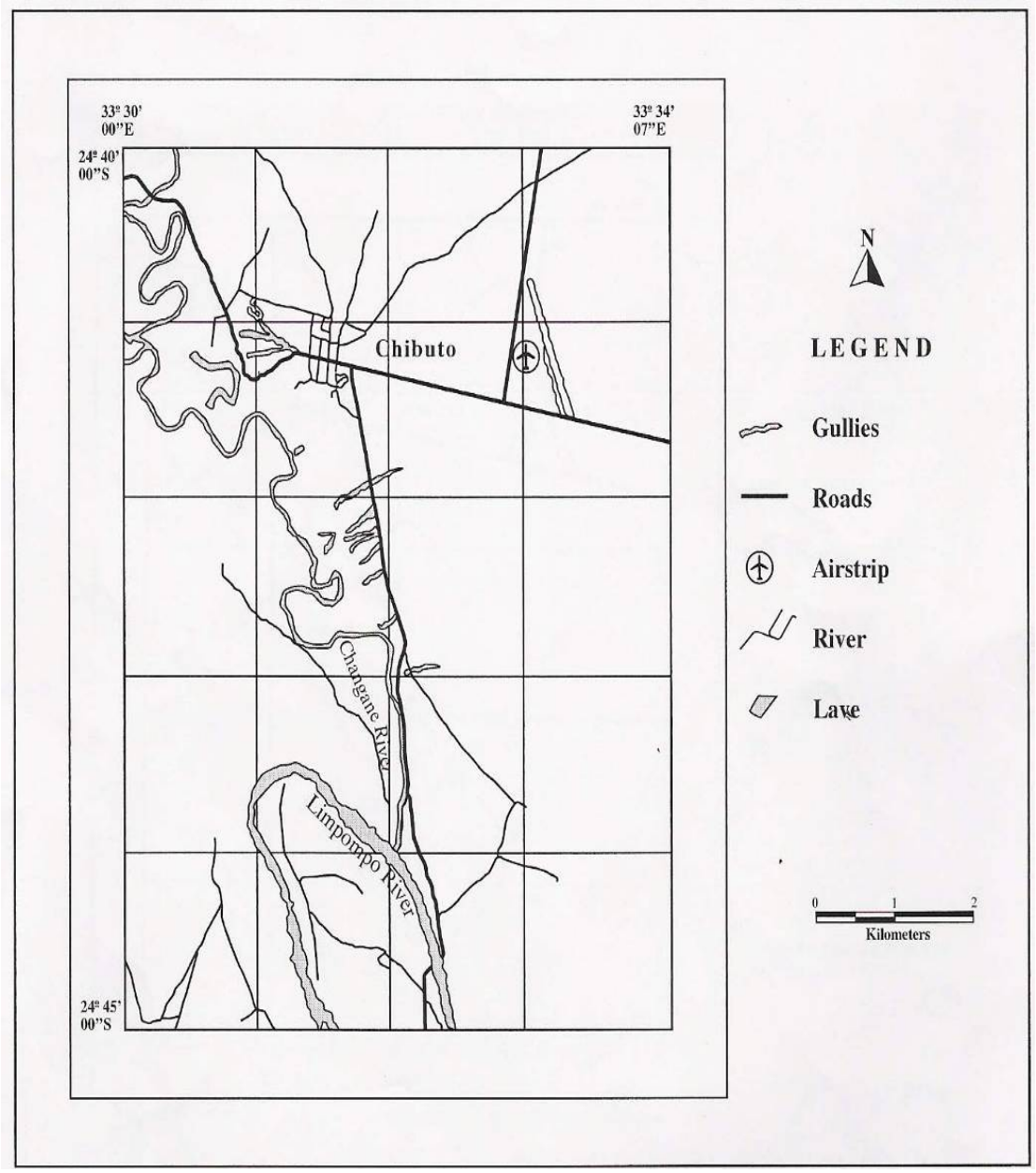

Fig. 6.4: The location of large gullies in South Central Chibuto. Note that the gullies start along the main road crossing the landscape perpendicularly to the predominant gradient from uplands to floodplain.
Source: Feitio (2004, 32).

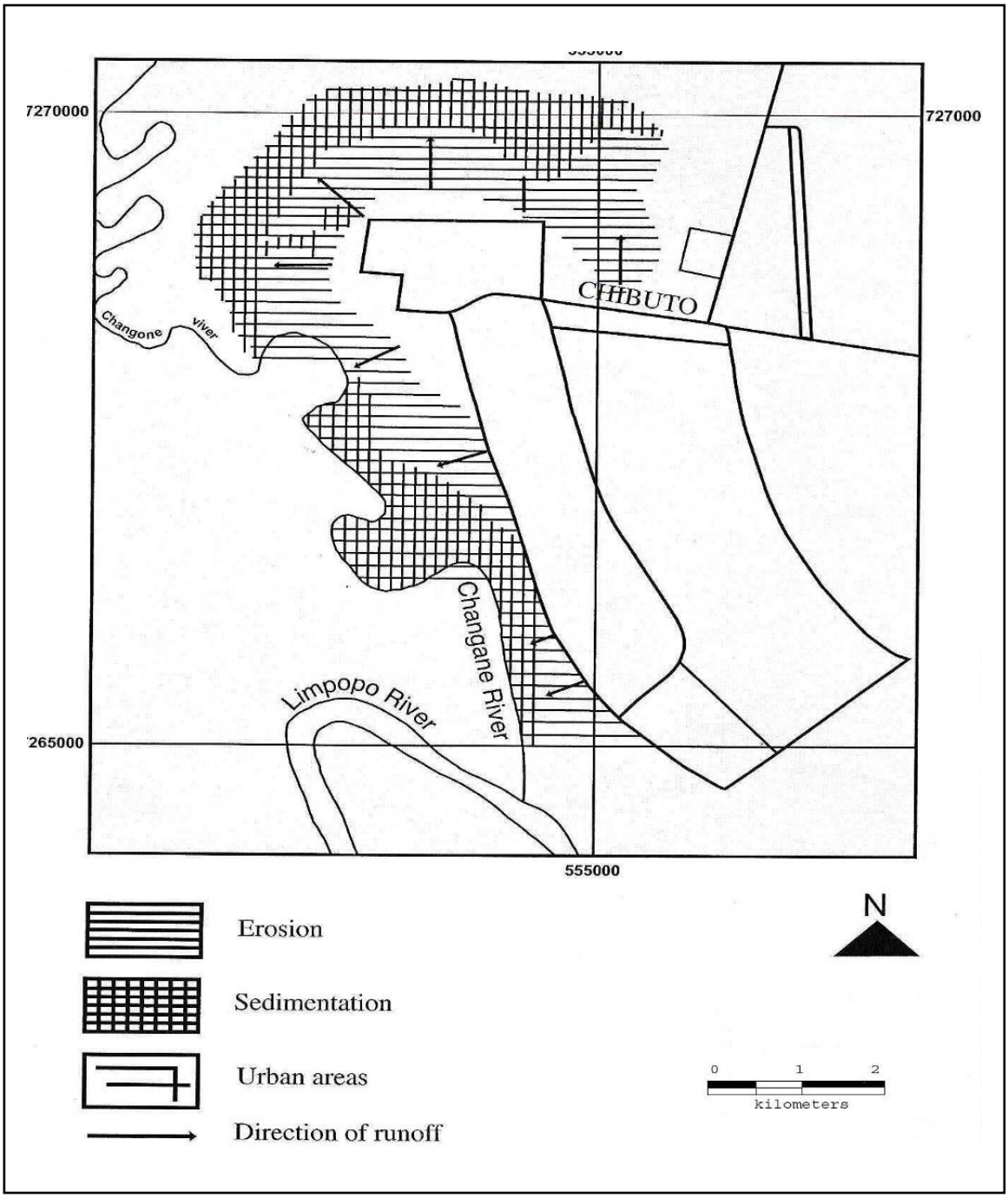

Fig. 6.5: Areas severely affected by soil erosion in South Central Chibuto.
Source: Topographical map of Chibuto, satellite images and field work.

Around pastures, mostly situated in marshy land, and around lakes and riverbanks, the vegetation is destroyed by over-exploitation and land-clearing to open fields, and also excess grazing and trampling by animals.

Due to the location of the pastures in the low lands, the main form of degradation of these lands is the sedimentation of thousands of tons of sandy material eroded from the urbanised areas; this sedimentation causes changes in soil proprieties and consequently alters the quality of pastures **(Figs.6.4, 6.5 and 6.6**) (Feitio, 2004).

Detailed observation of the processes of land degradation by soil erosion in the lowlands shows the following situation (Ombe, 1998: Feitio, 2004):

- Sediments cover a large extension of land under pastures of approximately 1000ha[16].
- This area changes in soil cover from clay soils to sandy soils.
- New types of vegetation are growing that are adapted to the new soil conditions.
- Sediments reach also lakes and the Changane River causing their siltation.
- The process is repeated in each rain event and no measures have been taken to deal with the problem.

The degradation of the Changane River was confirmed by the following description of a key informant:

> Muchanga, a 75-year old farmer, for example, when asked how he assessed the situation of the Changane River now and before villagization, argued that when they removed the houses lined along the river levee, they started to cultivate the former residence spaces. There was a process of clearing the grasses to the very bottom of the river so that erosion of banks occurred and accumulation of sediments made the Changane River shallower and the water dirty and smelly. According to Muchanga, the aquatic vegetation helped to keep the water clean (Muchanga pers. comm, 2004).

[16] Some studies caution that in a topographically complex landscape, soil sedimentation caused by soil erosion, may be considered land relocation rather than degradation with absolute decline in soil resources. Thus sedimentation may initiate a new trajectory of land-use and land-cover change (e.g. Behnke and Scoones, 1993).

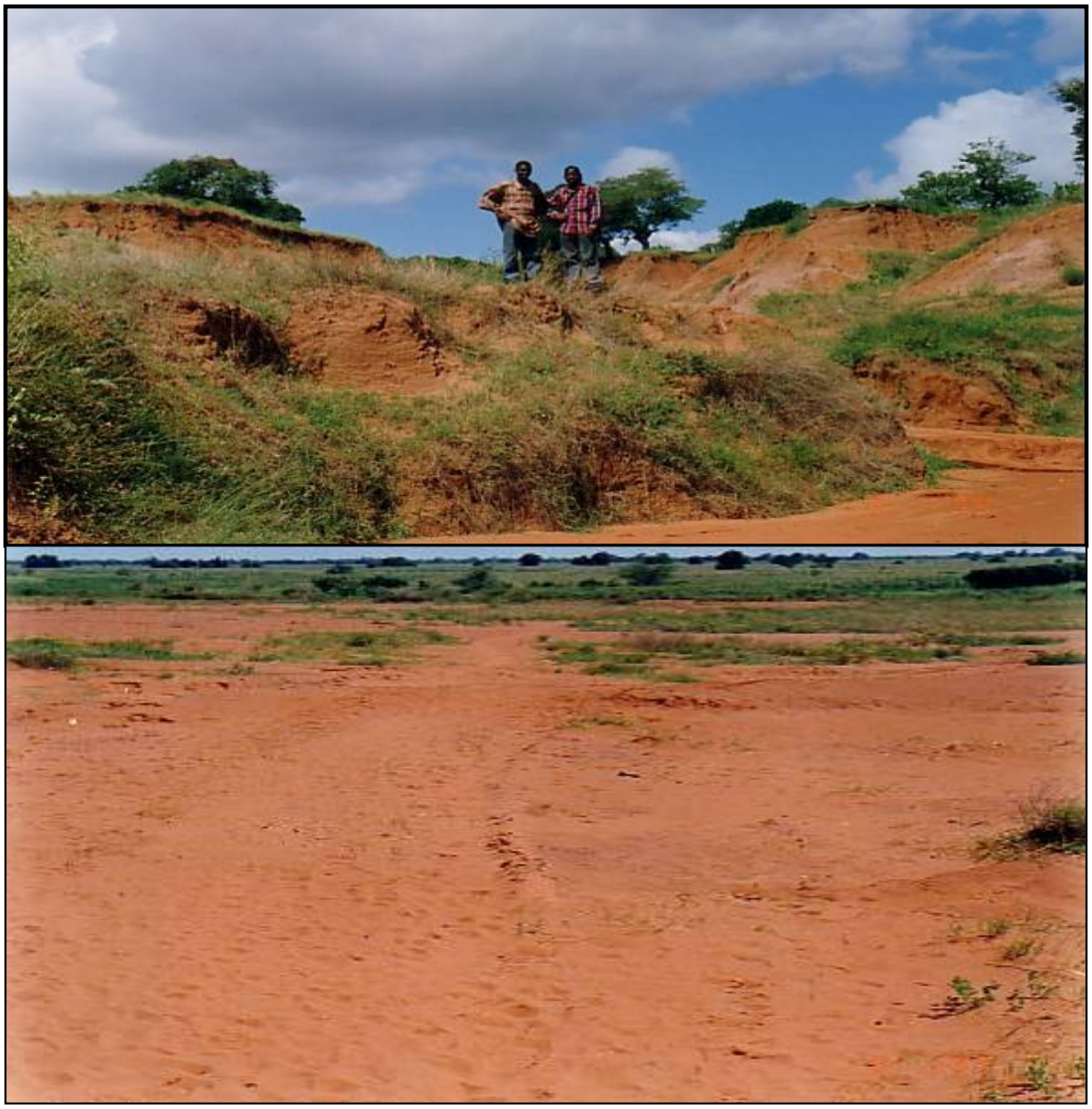

Fig. **6.6**: Soil erosion (in uncultivated lands) and sedimentation (in pastures) in South Central Chibuto, Chibuto, January 1999. Note the cutting of the steep slopes and in filling of flat land-covering extensive areas.

Land-use change during the period under study has been discussed During this period large pulses of land transformation occurred. The drivers of such change included a combination of developmental policy and shock events e.g. floods, causing massive resettlement of people and expanding urbanised areas. Attention now shifts to the discussion of the impact of land-use change and policy on the livelihoods of the people and at the same time on the way people adapt to changing circumstances.

6.6 The impact of the land-use changes in the People's livelihoods in South Central Chibuto

6.6.1 Constraints For Sustainable Livelihoods

Changes in policy and land-use during the study period, impacted most of the survival strategies used by local people to meet their needs, materially and spiritually (Mararike, 1999). The consequences of change, for example, affected access to basic assets of land and livestock, and dislocation in turn affected the social safety nets, including claims to assistance by local people.

6.6.1.1 Access to land

Land-use change in the last three decades brought about impacts on the living conditions of the peasants in South Central Chibuto. From PRA, questionnaires and informal interviews, it was found that there are several land claims in the area and that some households experience shortages of land and a shortage of fertile land in general. More than 50% of the households interviewed cultivate lands with sizes less than two ha.

In many cases, the lands are located in only one ecosystem, either *bila* or *serra***.** This situation increases the vulnerability to droughts and floods. The February 1999 and 2000 floods, for example, affected many peasants cultivating the Limpopo floodplain. Some of them could not rely on lands in other ecosystems. During the PRA discussions, for example, the issue of co-operatives and irrigation was also raised. Some participants indicated that the incorporation of land into irrigation schemes, without titles to this land, makes land holding insecure.

The uncertainties surrounding land claims are a consequence of the historic land-use changes, including the war[17]. During the socialist developmental experience, individual family farms were incorporated into large co-operative farms. The

[17] According to Paul Harvey as quoted by Watson, Black and Harrison, 1999, conflict can lead to a break down in the institutions in a society but simultaneously strengthen certain institutions and create others.

development of irrigation schemes also contributed to the change in the layout of the farms, thus making the legal claims of propriety rights difficult when a citizen intended to abandon a cooperative and work individually. Local traditional authorities who dealt with land allocation during the colonial rule, the *regulo* and chiefs, were substituted by the FRELIMO party structures (*Grupos dinamizadores*), who redistributed of the land. In some cases the traditional land distribution system was also ignored (PRA, 1999)**.**

Powerful organizations including the Christian Council of Mozambique and ORAM (PRA, 1999), have also participated in land relocation due to the fact that they fund co-operatives. According to Mariana Tivane, the constant change in land relocation structures and procedures gave some individuals, e.g. the leaders of the NGOs funding agricultural development opportunities to acquire land, which they are not entitled to according to customary law (Mariana Tivane pers, comm., 1999). Before independence, the lineage leaders and family heads mediated the process of land negotiation.

In Mozambique the role of traditional authorities, those who had served under colonialism, have only recently been recognized and they still have to adapt to new circumstances. During the war, much land has been redistributed to displaced people without the acceptance of their traditional owners (Bonifacio Wate, pers, comm, 1998: Myres, 1994). Drought spells and the war, as well as the decimation of cattle had created the illusion that there was plenty of land that could be distributed to newcomers displaced by the war.

As a consequence, a significant number of peasants have not inherited the land as was expected from the rural area under traditional land-use practices (**Tables 6.5 and 6.6**). Land claims are centred in the more fertile *bila*, which can be cultivated intensively, growing commodity crops such as beans and horticulture and maize that is the staple food of the region.

Table 6.5: The size of cultivated lands.

<1ha	1-2 ha	2-3 ha	>3ha
59	43	25	17

Table 6.6: Sources of land.

Type	No. of responses
Inherited	78
Borrowed	55
Given by the Govt.	34
Bought	4
Other	11

Table 6.7: Land-use before communal villages.

Type	No. of responses
Forest	30
Somebody else farm	61
Somebody else fallow land	34
Other	13

In 1977, during the resettlement process, people acquired an entitlement to a previously traditionally demarcated plot of land that belonged to the old residents of the area (**Tables. 6.6 and 6.7**). The questionnaire sought to know what the respondents found when they first arrived at a given place for settlement. This was intended to identify the kind of land-use and land-cover conversion undertaken in the period of communal villages. These data from the questionnaire corroborates data from aerial photographs and from PRA. In the period before communal villages, during the mid 1970s, there were two distinct types of agriculture in the *serra*, the traditional agriculture with long-fallow and traditional agriculture with short-fallow, where the farms were interspersed with the residences.

Thus, those who inherited somebody else's farm or a land under fallow are those who settled the lands under short-fallow and traditional agriculture, while those who settled in the forest are households occupying the periphery, which were closer to the land with long-fallow. These changes in entitlement to resources, however, did not cause remarkable land conflicts; rather several opportunities for livelihoods were generated by such changes in land-use.

6.6.1.2 Problems in agricultural production

During the last 35 years, a range of factors affected the access to assets and claims. During the war, people have lost their assets of durable investment including cattle. The manifestation of this was the pronounced lack of draught power because cattle was stolen and killed during the war. This was further exacerbated by the 1991/1992 severe droughts, which could have additionally led to the death of a considerable number of cattle (**Table, 6.8**). Oxen teams have not been widely used because they have been too expensive to hire for the local farmers, costing about $70 per hectare to till. In 1999 the minimum official monthly salary in Mozambique was approximately $40 and in the countryside this amount was less than $40.

The lack of draught power can be illustrated by the fact that only 15 of the 146 households interviewed farmed cattle and the number of cattle was of 51 head. The

2000 catastrophic floods exacerbated the situation in South Central Chibuto and at district level:

> A rural worker retired in 1988 from a private farm job, was earning, $4 as pension until his death in 1998. He could survive thanks to the remittances of his sons working in big towns and scarce agriculture produce from his wife (Gwevani Ukalangue pers.com, 1997).

The claims on relatives living in towns were important during the colonial period. Nowadays, however, principally during the years of the implementation of the Structural Adjustment Policy, levels of real wages were reduced and sending remittances home has become increasingly difficult (Scoones *et al*., 1996; Mozambique, 1998). As a consequence, the harvests have not been adequate for the majority of the peasants. Communal villages, war and pests could have discouraged people to farm cattle.

The Government of Mozambique has promoted the recovery of livestock stock numbers through loans. The type of cattle used is imported mostly from Zimbabwe and the cattle suffer from the lack of adaptation to the local environment (Mariana Tivane, pers, comm, 1997). Mariana Tivane reported that she was given a loan of two cows for cultivation; one died from a disease and another died because of eating poisonous grass. Local varieties of cattle are adapted to local pastures and are more resistant to droughts. These, varieties are, now, however, very rare.

Structural Adjustment Policy, impacting on peasants impoverished by a long period of war, is one of the main root causes of the difficulties in funding traditional agriculture. The rise in producer prices to stimulate crop production negatively affected the poor producers who cannot harvest enough for their needs. Without significant alternative sources of income, the increase in prices only in urban areas can be compensated by a correspondent increase in salaries:

> "The National Prices and Wages Commission announced increases of up to 100 per cent in prices to be paid to farmers for some of the country's main crops. The producer price of maize rises by 69 per cent from 65 10 110 meticais per kilo, while rice now brings in 145 meticais a kilo rather than 75, an increase of 93 per cent the producer prices of oil seeds id doubled from 35 to 70 meticais a

kilo and that of beans and peanuts rises by 53 and 70 percent respectively" (Mozambique file, No 148¸ Nov 1988).

A similar situation has been observed in other southern African countries in rural communities, where people with limited asset bases of land and livestock find it very difficult to secure a livelihood from rainfall agriculture in dry land areas, because of declines in real wages levels and increasing levels of unemployment. Households are therefore usually grain consumers rather than producers (Scoones *et al.*, 1996; Mararike, 1999)[18].

Table 6.8: Causes of food shortages.

Causes	No. of responses
Floods	38
Droughts	124
Pests	92
Land shortages	14
Shortage of seeds	11
Shortage of tools	11
Poor land	11
Shortage of labour	4
Other	8

During the PRA conducted in January 1999, the majority of the peasants found that the seeds were too expensive, and as a result the inter-cropping of crops was jeopardised. Poor peasants could only afford to buy one type of seed, including maize. Cowpeas, beans and groundnuts seeds were the most expensive and their prices could average USD 1, 5 per kg in 1999. It is particularly important to mention that during the war, coupled to recurrent dry spells of the 1980s, many farmers lost their seeds and stores of traditional varieties through abortive seeding.

It is important to mention that many peasants had not been able to build their traditional huts for storing maize in which smoke from cooking fire is a device to protect the grain from pests. South Central Chibuto is located approximately 200km away from Maputo, from where the seeds are purchased by local merchants and

[18] The study shows similarities with other assessment in southern African countries principally with

which are finally sold at higher prices, due to additional transport costs.

Having discussed issues relating to the importance of agriculture for food security, attention now shifts to examining access to basic social services, which are very important to sustainable livelihoods, in the area.

6.6.2 Access to social services and sources of energy

6.6.2.1 Education and health care

In the study discussed here, a network of three primary schools and one secondary school provides education for local people. Distance to school was not considered as a major problem. 90% of the children of school age attend existing primary schools (**Table. 6.9**). At the lower primary level (Four years of education), the government subsidizes books and nearly all households can afford to send their children to school. Problems presented are related to the didactic material for upper primary and secondary school levels, which is considered expensive and not subsidized by the Government. It seems that the majority of households find serious difficulties in sending their children to upper levels of education, due to their lack of means to pay for didactic material and other expenses. Only 16% of the children in the study area attended the upper primary and eight percent attending secondary level. The majority 76 % is overwhelming at the lower primary level.

Table 6.9: Number of children attending local schools.

Category	Lower primary	Upper primary	Secondary	Total
Boys	78	5	9	92
Girls	73	10	6	89
Total	151	15	15	181

Source: Questionnaire. Note the sharp decline in number with increase in the level of education.

There is one hospital in the study area. During the PRA, some participants

Zimbabwe, due to the implementation of the Structural Adjustment Policy and climate variability.

complained about the long distances that they have to walk to and from hospital. In many cases, there was not enough medicine. However the sanitary situation was considered reasonable. All households use latrines even in the over-crowded areas. The communal villages programme through mass mobilization for education and immunization, helped to eradicate the old habit of using the bushes as toilets, which resulted in the propagation of diseases. During the first years of independence Mozambique was considered a success story in promoting preventive-health care in the country.

6.6.2.2 Water supply

The access to water was considered a problem. During discussions, it emerged that the women of some households had to travel five to seven km to fetch water after returning from farms, some of them, located 10 - 15 km distance. This also leads to loss of time available for production and learning, principally, for the young girls who are mainly responsible for water collection and storing. Efforts to get water are not only related to the distance but also to the topography. When people return home with water on their heads from the bottomlands they have to climb the dune escarpment to their homesteads in the *serra* plateau.

6.6.2.3 Sources of energy

The main source of energy is biological (e.g. fuel wood and charcoal). All households interviewed use timber as the only sources of energy. Around the homesteads, the forests are already cleared; permanent cultivation and construction of houses have substituted fallow-land bushes, which had been used for timber. People travel long distances, more that 10 km, to collect timber but a great number of poor farmers use the trees planted around the homesteads for cooking and heating. Dried branches and twigs of trees, including fences made of plants, are all used to cook meals. When they do not buy timber, which is affordable only for very few households, people also collect dried branches of cashew trees located in areas, which had been abandoned during the war, situated seven to 10 km away from the homesteads as well as parts of cultivated crops from harvests even after they are prematurely dried.

6.6.3 Opportunities for improved livelihoods in South Central Chibuto

6.6.3.1 Gardening

The Villagization programme and massive urbanization in general have been the focus of much criticism. The main issue is the socio economic impact of radical change from rural traditional living conditions to more urban like environments. The communal village plot of 30∗40m size is considered inadequate to peasants' needs and lifestyle (e.g. Araujo, 1988; Casal, 1996).

Notwithstanding the constraints of this rapid urbanization local people have found adaptive strategies to cope with land scarcity. One of them is the intensive use of residential space[19]. Food crops, including sweet potatoes, cassava and fruit trees (e.g. Cashew trees and *Mafurra* trees) are grown in residential spaces. Some crops, including sweet potatoes, are grown under big trees such as cashew and *mafurra*, thus economizing on limited space (**Tables 6.9 and 6.10**).

When rains are regular, gardening can produce abundant food. Fruit trees also provide sources of income. Cashew fruits, for example, are used to produce wine and distilled alcoholic beverages. The nuts are sold in local shops; although it was not possible to quantify the number of trees, it was observed that there was a tendency of households to maintain as many cashew trees as possible due to their economic importance.

The leaves of cassava, beans and sweet potatoes play an important role in the local diet. In years of irregular rainfall peasants do not manage to harvest the fruits and tubers of most of the crops, but they do manage to harvest the leaves. The leaves of these vegetables are harvested gradually along the year on a daily basis. Cowpeas are the most cultivated garden crops because they are drought-resistant.

[19] This shows the existing flexibility and capacity for the re-creation of lost diverse livelihoods, through improvisation and innovation (Leach and Mearns, 1996; Scoones *et al*., 1996; Mortimore and Adams, 1999) rather than considering communities as passive victims of political economies or development strategies.

The crop types may vary from house to house depending on the taste of each grower. Beside traditional crops, cabbage, garlic, sugar cane, and peri-peri are also found in limited areas of the residences.

Other garden crops found include maize. Due to regular rains in January 1999, when the study was undertaken, peasants living in the less densely populated areas also cultivated public spaces around their residences including streets which are not used by traffic but occupy considerable large spaces in communal settlements areas (e.g. Samora Machel Village).

Table 6.10: The most important garden crops.

Type	No. of responses
Cassava	90
Beans	111
Sweet potatoes	68
Maize	30
Pumpkins	10
Other crops	20

Table 6.11: The most important garden fruit-trees.

Type	No. of respondents
Cashew	129
Mafurra	126
Mango	122
Canyo	20
Other	19

Data on garden crops draws on questionnaires undertaken in Samora Machel and 25 de Junho villages and were complemented by field observation and showed that the peasants are not passive victims of the developmental policy, but, instead, have creatively managed to adapt to new circumstances by introducing crops from the *bila* ecosystem including a variety of beans and sweet potatoes. In the *bila* fields, as well,

they have successfully introduced cowpeas and cassava in a less clayish variety of soils. Nearly all of those interviewed possessed at least a variety of fruit trees. Mango, Cashew and *Mafurra* trees are used for shadows and at the same time they minimize the shortage of fuel wood. Other important trees grown are, for example, bananas, citrus and palms.

Due to the importance of the fruit trees, mostly cashew, on peasant's livelihood, the canopies of these high growing trees densely cover the communal settlements together with the *Mafurra* trees. In aerial photographs and satellite images, the bare soil of the communal settlements streets can hardly be distinguished. The change in the crop types in the condition of urbanization, under non-innovative intensification was seen as wide spread in the tropics (Keys and McConnell, 2005). In the case of South Central Chibuto, both market liberalization under Structural Adjustment Programme and Urbanization seem to be the key factors favouring the increase in garden crops and trees.

6.6.3.2. Migration and improved livelihoods

Migration to South Africa continues to play an important role in the life of Chibuto, as was described before. Although there was a reduction in the number of miners recruited from Mozambique, the salaries of the few involved and their impact on the economy is likely to increase (Covane, 1996**) (Tables. 6.10 and 6.11**). These miners are in many cases the most qualified and are capable of setting up businesses at home

Some miners have purchased cars for informal transportation and have bought agricultural implements. The number of stone houses and zinc-roofed houses has increased and this can contribute to reduction of pressure on natural vegetation, which is traditionally used as construction material (**Table 6.12**). The following table shows that the number of houses with different types of materials where the number of zinc-roofed houses almost equals the number of those roofed by thatch. In the region, the households are still highly dependent on biological material for the construction of walls.

Table 6.12: Type of construction material of the houses.

Type	No. houses
Walls of cement	45
Walls of reeds	173
Walls of adobe	6
Thatch roofed	123
Zinc roofed	122
Floor of cement	85
Floor of earth	125

During the PRA, the participants recognised the increases in the number of zinc-roofed houses as having an impact on the local environment. When asking participants about the causes of soil erosion, for example, they unanimously blamed the zinc roofs, which collect large quantities of water, plus the reduced distances between residences in the present era as the main causes of soil erosion. This was considered as a major change because it was radically different from the traditional scattered settlement pattern (**Table 6.13**).

Nowadays, labour migrants are relatively educated people who have attended local schools with seven to eight years of education and have benefited from the massive education programmes of the years immediately after independence (First, 1983; Covane, 1996). This generation of miners may use the money relatively wisely and invest in the education of their children. Colonial period miners were mostly illiterate and were victims of forced labour and dishonest local merchants (Covane, 1996; Wuyts, 2001).

The improvement in the communication network and the atmosphere of democracy and co-operation between Mozambique and South Africa is also important for the livelihoods of migrants' families. Firstly, this improves information needed by the migrant for adequate decision making. Secondly, improved relationships between South Africa in Mozambique are important in dealing with miners' issues when they are retired or retrenched. Projects are being delineated involving mining companies in RSA, to resettle retrenched miners in economic activities such as food production in

co-operatives. These projects are very important in the re-integration of former mine workers, since they enable them to produce foodstuffs for sale for their families (Taimo, pers.comm, 1998; Mavila pers, comm, 1998; Jemusse, pers.comm, 1999).

Table 6.13: Sources of remittances other than the income from farming.

Source	No. of responses
Wages earned from work in Mozambique.	20
Wages from labour migration to South Africa.	56
Pensions from work in Mozambique.	3
Pensions from labour migration to South Africa	1
Informal commerce	20
Other	5

6.6.3.3 Informal activities

Informal activities have increased in importance over time, creating alternatives to farming. The emergence of this activity in Mozambique after a policy of Central State control occurred during the war and after implementation of the Structural Adjustment Policy. Women in rural areas are the most important actors in these activities. The informal activities include brewing and selling of alcoholic, beverages, selling of foodstuffs and construction materials. Selling of second hand goods such as clothes and shoes are very popular among the informal activities in Chibuto (Boudreau, 2001; INGC, 2003).

Women have also begun to legally migrate in a circular fashion to South Africa where they buy manufactured products, mainly clothes, and sell them in Chibuto. Trans-border migration however, is practised by women who have a certain level of education and who can speak both Portuguese and a bit of English. These women establish a web of agents who will sell the goods in different localities, thus giving this activity a multiplier effect in terms of income generation and employment (PRA, 1999).

6.6.4 Rural development policy: democracy and participation

Another important opportunity for people's livelihoods is the overall developmental policy already shown, and the peace achieved in 1992. In 1990, for example, a new democratic constitution was approved based on a multiparty system and in the 1994, 1999 and 2004 general elections occurred to elect a national democratic government. In 1998 and 2003, the local government elections took place as well as the implementation of democracy at the local level. Since the mid. 1980s, NGOs have worked throughout the country, introducing their philosophy of development through people's participation. In South Central Chibuto, co-operatives are being funded by the Christian Council of Mozambique with the aim of increasing agricultural production through irrigation and better management of land resources. Other NGOs including the Association of the Friends and Natives of Chibuto, Save the Children, Care International, are involved in other projects.

Having examined the impact of land-use change and its impact on the people's livelihood, attention now shifts to examine some of the general trends in land-use change in the period under study emerging from the overall development strategy in Mozambique.

6.7 Possible Future Environmental Changes in South Central Chibuto in the Era of Globalization and Post-2000 Floods.

> "Rapid land-use changes often coincide with the incorporation of a region into an expanding world economy. Global forces increasingly replace or rearrange the local factors determining land-uses, building new, global cause-connections patterns in their places" (Lambin *et al.*, 2001, 266).

6.7.1 The Chibuto Corridor Sands Project

In 1997, ilmenite mines were discovered by the Southern Mining Corporation. This event is expected to drive Chibuto towards more industrial and intensive land-use, contrary to the past historical pathway of environmental change. Extensive geological investigation has been completed, consisting of a drilling programme in the Chibuto

serra where it was found that the concentration of economically viable minerals is capable of sustaining mining operations at scale of the largest mineral sands mining in the world for well over 100 years (WWW.icon.co.za).

The origins of mineral deposits is related to the erosion of rocks over millions of years by rivers into former beaches, and the sands containing minerals were blown into the dunes by prevailing winds after marine regressions (Thompson, 2003). The mineralization is contained in paleo-aeolian sand dunes forming interior dune cordons along the east coast of Africa. The dune belt is sporadically found from the Wavere crest in the former Transkei, through Mtumzin–Eupangueni to Chibuto and onwards along the east coast through Kenya to Somalia (Coastal and Environmental Services, 2000a). The major mineral constituent in the sands is quartz, followed by the valuable heavy minerals (Ilmenite, Rutile and Zircon), magnetite and sodium and potassium feldspar (Yager, 2000; www.icon.co.za).

In 2001, in South Central Chibuto, the process of prospecting and the environmental impact assessment of the minerals were undertaken (Macuacua, 2000; Coastal and Environmental Services, 2001). Standard processing smelting technology will be used to recover valuable heavy minerals. A power-line from Maputo near Mozal Aluminium smelter will be constructed. Huge quantities of water supply, will be needed, 17.000 to 135.000 m^3 per day (Coastal and Environmental Services, 2000b**).** The production of the smelting plant will be transported by trucks to a port to be constructed on the coast of the Gaza Province.

Because of the mining project, a fast-shift in land-use is expected, from development based on the use of local natural agricultural resources with a low pace of capital accumulation and very few people involved in a formal economy, to a more intensive capital investment in the mining industry. The project needs for its development, the resettlement of thousands of families, not only to open mines but also to build infrastructure including factories, power-lines, roads water-ways and reservoirs. The degree of environmental transformation is expected to be relatively high and of unpredictable magnitude, although EIA reports point to moderate impacts. This is because recommendations for the mitigation of adverse environmental impacts shown

in EIA documents are not the solution *per se,* but the existing capacity of law enforcement within the local authorities, both formal and informal(Coastal Environmental Services, 2000a).

The opening of the markets to foreign capital including the liberalization of the trade with South Africa and proliferation of informal commerce is already affecting small-scale agriculture, for local markets. South African agricultural products which have lower prices are replacing local products (PRA, 1999). The most important question is how the project will affect the pattern of natural resource management and the life of local communities in general. In order to respond to this question two scenarios are discussed.

6.7.1.1 The marginalization of local people

According to pessimistic views on globalization, the expansion of markets by international corporations and trading companies is possible by concurrently undermining and destroying the domestic and local productive base. This is because, on the one hand, barriers to movement of money and goods are removed and credit is deregulated. Consequently, land and state propriety are taken or rented over by international capital (Chossudovsky, 1998). On the other hand, global capital projects may not be able to deliver the benefits of high rates of economic profitability amongst the poor (Escobar, 1996).

The marginalization of the local population may occur if the main suppliers of foodstuffs and social services of the mining compounds are foreign agents competing with local providers. This can be exacerbated by the fact that land to be taken for mining activities may hamper the traditional risk-avoidance strategies of relying on diversity of the environment with differing land-use capabilities. This because it is known that:

> "in early-development rural areas, non-farm enterprises are mainly linked to local agricultural economy, benefiting from the natural protection of poor roads"(Ashley and Maxwell, 2002, 3).

Another consequence of the project is the fencing of large areas and the consequent blocking of the traditional trails of people and cattle so that the traditional movement of people and assets may become difficult.

Households constituted with relatively aged and poor members, in many cases, cannot afford to travel for cultivation. Additionally, people have to shift to other sources of income, including the socially less dignifying informal commerce, which also needs capacity to travel and possess certain level of literacy.

Marginalization of local actors may also be induced by the impact of new factors like the HIV/AIDS pandemic. This pandemic has shown the likelihood to reduce the already scarce male labour force due to the traditional pattern of migration to South Africa. In addition, AIDS disrupts the household capacity to invest in agriculture and other activities by channelling valuable assets, including cattle which are being sold to pay for the treatment of sick members. This scenario reduces the competitiveness of local communities in a market-driven economy.

Already existing degradation is affecting the most valuable resources including wetlands and lakes by deposition of sandy sediments in these landscapes. It diminishes the opportunities for diversification of the economy including ecological tourism. Resettlement usually leads to the deforestation for residence construction and for opening of fields for food crops. In-migration, caused by the attraction of modern mining activities, is likely to increase the demand for commercial fuel wood and food crops (McConnell, 2003).

The competition over land and potential land disputes is another issue to take into account. Big projects and monetization of the economy in general, induce people to perceive land as a viable asset for quick money earning thus leading to further impoverishment. Land sales by people in need and under pressure by changing situation often lead to the disruption of the social networks and institutions, which play a key role in mediating human interactions with the environment. What makes people sell land and move to areas furthest from the central cities is caused by relatively better-off urbanized newcomers in the changing social environment.

Because of the novelty of the mining project, local authorities may take time to adjust to new circumstances thus losing the balance of power struggles with new constituencies.

6.7.1.2 The opportunities: the win-win scenario

Positive approaches of globalization focus on its capacity to create spin-off opportunities that arise from "crowding- in" of private and public sector investment, and lift regions of historic under-investment which are expected to develop according to economic potential of a locality (e.g. mineral resources)(O'Keefe and Howorth, 1999). The World Bank view, for example, highlights the demonstrative effect of global production projects in local realities (e.g., exposing local people to new technologies and managerial skills) (The World Bank, 2003).

The diversification of the local economy with the advent of increased purchasing power involved in mining and the stimulation of local economic activities is possible. This can lead to the development of local agricultural activities both in crop production and in poultry and cattle to satisfy the demand for a growing urban market. However, this scenario can be hampered by the lack of capital and attraction of newcomers with more intensive investment capacity, when the use of machinery may marginalize a large sector of poor peasants. For example, a well-funded agricultural extension may help to increase the crop yields and compensate the reduction of land available.

An alternative for the diversification of economic activities may be the inclusion of moderate capital investment like ecological tourism which relies on the diversity of the ecosystems and also explores a series of historical and cultural heritage of a region, which so far is not used for economic purposes. However, the involvement of the local community should not be taken for granted because there is usually a power struggle between local communities and the interests involved in the mining industry. This involvement may be constrained by the lack of professional skills of local people and fast growing modernization.

One of the sources of job creation may be the rehabilitation of existing degraded lands by using the assistance of the mining project community's development funds, as is being practised in huge projects such as the Mozal Smelting Factory (Mondlane, 2004).

Finally, the local market will, possibly, become a place of global exchange which exposes local communities to an endless myriad of goods, but at the sometime, this diversity of experiences can be adapted to local circumstances to add value to local natural and human resources both. In summary:

> "Although environmental effects of macroeconomic policies and trade liberalization are particularly important in countries of fragile ecosystems (e.g., semiarid lands and mangrove forests), international trade and other forms of globalization can also improve environmental conditions through green certification and eco labelling, wider and more rapid spread of technologies, better media coverage allowing international pressure on states that degrade their resources, and free circulation of people, which provides better educational and employment opportunities"(Lambin, Geist and Lepers, 2003, 221).

The above citation and other literature sources, explain the complexity of the pathways of environmental change and their impact and how they make future became uncertain. It is confirmed that that ecological consideration is not an arena of unproblematic political technical intervention. This uncertainty is exacerbated by the impact of HIV pandemic, which is examined in the next section

6.7.2 The challenges of the HIV/AIDS pandemic and the future

The rate of HIV/AIDS infection in the study area is increasing with alarming proportions (Lifestories, 2002, 2003 and 2004). The most active part of the population is the most affected**.** The HIV/AIDS pandemic is closely related to the migration of male members to South Africa who are more prone to promiscuity during their long stay in the mines in Southern Mozambique where the prevalence is estimated of approximately 16% against the national 13 % (*www. usaid.gov*)**.**

This situation has a great impact on the availability of labour and non-farm sources of income, which are undermined by the need to treat sick members of the household. The productive capacity of the household is thus seriously affected. The HIV/AIDS pandemic also generally affects social cohesion generally among kin members with a tendency for them to make accusations e.g. witchcraft.

The aggregate effect of this pandemic, however, is difficult to measure because it is a new stressor, which the population is still learning to deal with. It is also not well understood, often causing heightened periods of uncertainty for households (Vogel, 2004). What is certain is that it will, as it did in other parts of the world, have a strong negative impact on the people's livelihoods. Some of the causes of negative impact may be summarized as follows:

- Households lose their breadwinners and become more vulnerable.
- Households lose the more active members, the providers of non –farm sources of income, which complement the investment in farming e.g. those who are able to migrate for employment.
- Households lose many assets of long-term investment including cattle and other valuables for the treatment of the sick. In South Central Chibuto this includes also assets like cattle, sewing machines, furniture, poultry, etc.
- Children grow with less care and without proper education and training for farming and have to cope with environmental constraints so undermining the way knowledge is passed from parents to children and can be valuable skills of production and conservation of local varieties of crops (www.irinnews.org/).
- Social cohesion needed in order to cope with shock events is undermined by the pandemic as extended families struggle to cope with multiple new dependents (*www .usaid.gov*).

6.8 South Central Chibuto: a complex trajectory of environmental change

The combination of research methods undertaken in this study helped to expose a particularly rare case of environmental change in the Southern African region. In many studies, the political economy aspect is the main factor which was found to be causing, not only environmental change but also, shaping policy on land-use. Interpretations of environmental degradation deriving from the application of certain theoretical assumptions including carrying capacity and equilibrium are the main issues of concern in Southern African studies on environmental change. South Central

Chibuto case, it is argued, exhibits a more complex trajectory of change, where a mixture of political economic structural factors and other socio-political conjectural factors interact to shape environmental change. The biophysical environment responds in a complex way. In certain cases, it impacts negatively on local livelihoods through climatic variability while in some cases it is a source of diversified livelihoods.

Sudden biophysical events like floods, for example, may trigger changes in land-use leading to resettlement. Resettlement as was shown earlier, has the potential to affect livelihood strategies and force new adaptation techniques.

The complexity of the trajectories exposed and their multiple causations in the area under study makes the area a 'laboratory' for further studies, aiming at capturing a more nuanced picture of environmental change. For that to effectively take place, other research tools enabling the increase in resolution in an already local scale study are, however, needed.

Summary

Land-use change in South Central Chibuto is related to the intensification, conversion and modification of land-use as a result of diverse drivers, both natural socio-economic, as well as a combination of both. The intensification of land-use was characteristic of the colonial period under the influence of the commoditisation of the economy, mostly in the bila lands.

The post-independence phase, related to the conversion of the former traditional agricultural landscape was converted into an urban land-use under the policy of the socialization of the countryside.

The war which ravaged the region from 1983 until 1992 caused a further intensification of land-use, due to the resettlement of displaced people from different parts, some of them occupying unsafe areas.

Both conversion and intensification occur simultaneously. Land under intensive use during the colonial period has been converted into both communal villages and co-operatives and state farms. Land which has been under pasture and less intensive land-uses were increasingly used for different purposes, ranging from timber gathering, construction material gathering and house construction during the war.

Physical drivers such as droughts and floods played an important role in land-use changes because they influence decision making and provoke population migrations. They may also lead to intensification in some environments (e.g. bila) and de-intensification in other sites (e.g. serra).

Land-use and environmental change impacted dramatically on people's livelihoods. The cumulative impact of the different driving forces provoked several environmental problems, such as loss of biodiversity, soil erosion and sedimentation.

The future trends of environmental change in South Central Chibuto are mostly linked to globalisation, with South Central Chibuto continuing to be a 'hot spot'. The HIV/AIDS pandemic will continue to be a serious threat to sustainable livelihoods unless adequate measures are taken to deal with it.